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- Germany -

by F. Nied

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RECONSTRUCTION OF TWO AND THREE AXLE PASSENGER TRAIN CARS OF THE DEUTSCHE REICHSBAHN

/Following is a translation of an article by Engineer F. Nied, Deputy Director of the Main Administration for Railroad Repair Yards, Berlin, in Deutsche Eisenbahntechnik (German Railroad Technology), Vol. VIII, No 4, Berlin April 1960, pages 165-175./

On 1 October 1959, the People's Chamber adopted the Law on the Seven-Year Plan for the Development of the GDR Economy from 1959 to 1965. Based on the decisions of the Fifth Party Congress of the SED, this law emphasizes as main task of the Seven-Year Plan: "Through the speedy attainment of the highest scientific-technical level, labor productivity and the production in all branches of industry must be raised to the maximum while costs are constantly reduced and thus the material-technical basis for the victory of socialism must be created and the growing demands of the people must be satisfied better and better." With regard to the main tasks of the Seven-Year Plan, it is further stated: "The successful implementation of the Seven-Year Plan requires the consistent application of the principle of strictest thriftiness in all fields of the economy in order to attain the best possible economic benefit in the interest of the constant raising of the people's property with the least expenditure of working time, material, and money."

With this goal in mind, the requirement in Section IV of the law must be read that the Reichsbahn must basically modernize at least one third of its passenger car park to improve commuter traffic, travel, and vacation traffic, and to raise travel culture. (Law on the Seven-Year Plan for the Development of the GDR Economy, GDR Legal Gazette, Part I, 1959, No 56, 17 October 1959)

In the first years of the Seven-Year Plan, the modernization affects first of all 3,000 two and three axle railroad passenger cars while in the last years of the Seven-Year Plan it is planned to modernize a large number of four-axle railroad passenger cars. This reconstruction program of the passenger car park is a contribution of the repair yards of the Deutsche Reichsbahn to the raising of travel culture and to the improvement of commuter traffic. Its purpose is the standardization of the available passenger car park and thus the reduction of servicing and maintenance costs of the cars as well as mechanical cleaning of both inside and outside.

The repair yards had already worked on the preparation of this reconstruction program since 1956. After the first test car had been completed in 1957 (H. Groth: A Successful Attempt, Fahrt frei, Vol. IX, No 10, 1957), and the 0-series had been built in 1958, the first series of reconstructed cars left the railroad repair yards in 1959, so that by the end of 1959 150 of these

cars had been added to the passenger-train car park of the Deutsche Reichsbahn.

1. Economic Considerations Regarding the Reconstruction of Railroad Passenger Cars

The overwhelming part of the passenger car park of the Deutsche Reichsbahn consists of two and three axle cars which until 1958 had been maintained in the four repair yards, Leipzig, Wittenberge, Halberstadt, and Gotha. About 70 percent of these cars had been built before World War I. They have wooden superstructural parts and consist of the most varied types of the former Land railroads (Illustration 1). The remaining 30 percent are new purchases from the years 1920-1930, which were built according to uniform blueprints in steel construction. Most of the latter were maintained in the Halberstadt Reichsbahn repair yard while the Leipzig, Wittenberge and Gotha yards were maintaining the cars with wooden superstructural parts at rising costs. In the meantime, these cars had reached an age where extensive replacement of the wood construction had become necessary and for which especially high-grade hardwood was needed (Illustration 2). The use of 2.5 cubic meters of hardwood for the general repair of such a car at a cost of from 25,000 to 30,000 DM for the installation of electric lights and hard upholstery (Hartpolsterung) was quite common. The reconditioning was done with craftsmen methods exclusively and because of the great amount of woodworking involved it was very expensive in terms of labor costs. Series and assembly-line production was not possible since the vehicles were not uniform in construction and, in order to avoid even higher costs, the vehicles had to be put back by and large into the old construction form, so that old usable parts could be reused. The product which left the repair yard, though relatively expensive, could again be used for transportation for 10-15 years. But it was a railroad car with the construction characteristics of travel comfort customary 40 years ago. (Illustration 3) A further great disadvantage for the economy consisted in the fact that the wooden superstructural parts require wood, a raw material in short supply, in future, too. Their further servicing and maintenance also required high expenditures for the fact alone that the vehicles are not standardized and therefore did not permit serial production in the Bww's and Reichsbahn repair yards. The application of modern methods to reduce the repair costs were also hampered by the old construction. This old construction furthermore was a major hindrance to mechanized cleaning of the outside because of the latter's uneven construction. Likewise, the arrangement of the seats and the heating installations hindered the use of modern interior cleaning equipment. Nothing was more logical than to eliminate these disadvantages by replacing the wooden railroad car bodies by modern steel bodies on the occasion of the general repair. (Oskar Schmidt, doctor of engineering; The Remodeling of Railroad Passenger Cars of the Bundesbahn /West German Federal Railroad/, Glasers Ann., Volume LXXIX, 1955, Issue 1) This idea was also supported by the fact that the trucks of these old two and three axle cars are still in relatively good condition and, because of the very large dimension of the trucks, the railroad cars have about another 20 years of life if steel railroad car bodies are mounted on the trucks and the latter get a good coat of paint even though they may be slightly

corroded. The brake installations, the working gear (laufwerk) and the draw-gear and buffer bar can also be retained with slight alterations. Especially the truck and the working gear require much material and need about 70 percent of the steel for a new railroad car. In terms of the requirements of new steel and the costs per seat, the renovated cars therefore need only about half of the requirements for a of a double-decker car and about a third compared with the new B4uep railroad cars (F. Nied: Increase the Modern Railroad Car Park. Fahrt frei, Volume IX, 1957, No 22). The political task of attaining "considerable improvement of the travel comfort in commuter traffic" will thus be solved with a significantly lower expenditure of material and funds than by a program of new construction. These savings in creating travel comforts corresponding to those of a new car is attained at the disadvantage of a not too long life of the railroad car and a higher weight per seat. Disregarding the political necessity, considered from a purely economic point of view the action is correct: The additional costs of renovation, about 20,000 - 25,000 DM, according to a rough calculation, should be amortized through savings in the so far customary costs of care, servicing, and maintenance of the cars up to the next main inspection (5 years). The savings result from the possibility of mechanical outside and inside cleaning of the renovated cars, the smaller maintenance costs while in operation, and the reduced cost of the annual inspection in the repair yard. The standardized cars moreover require smaller sparepart reserves than the many types in the past. Thus, there is again the possibility of saving current funds for maintaining spare part stock.

2.1 Development of the Renovated Car

The above-cited proof of the economy of the renovated car as well as the design for the reconstruction were worked up in 1956 by a collective of the Main Administration for Railroad Repair Yards, the "Einheit" Railroad Repair Yard, Leipzig, and the Technical Central Office, headed by the author of this article. One car was produced by craftsmen and was handed over to operations for testing. (H. Groth: A Successful Attempt. Fahrt frei, Volume IX, 1957, No 22) It was a special achievement of the craftsmen of the railroad car department of the "Einheit" Railroad Repair Yard, who, working only from sketches, applied all their knowledge and know-how to give the car an appearance in keeping with the best principles of repair work. There arose a violent dispute concerning the construction of this car, especially concerning the economic considerations, in which Fahrt frei supported the collective and thus made a significant contribution to the implementation of the proposal for reconstructing the passenger cars.

The exterior and the interior view of the car is shown in Illustrations 4 and 5. Its significant characteristics were:

Mounting of a steel car body in welded construction on an existing truck of a former P 12a car lengthened to 12.92 meters. Widely tested standardized parts were used on the car. The windows and benches corresponded to those of the double-decker train, the sliding doors to those of the B4uep car, electric lights, and low-pressure steam heating according to the postwar development of the VEB Vehicle Equipment Enterprise. The passages between the

cars were provided with rubber bulges (Gummiwulst) and in their upholstery, lighting, ventilation, heating and equipment of their wash rooms, the cars corresponded to modern passenger train cars for commuter traffic. The outside walls and the roof were made in such a manner that they could be produced by relatively simple welding equipment and that they afforded the possibility for mechanical cleaning. The car contained 56 seats by an arrangement, similar to that of the double decker car, where there were ten seats in each compartment. The following were special characteristics of the construction: Use of tested and standardized replacement parts; interior walls made of hard-fiber board, which were coated with baked enamel prior to installation; to reduce the possibility of corrosion no window or ventilation shafts; easy accessibility to lines and equipment requiring maintenance during operations.

2.2 The Cars of the 0-Series

The first cars were tested in Bezirk Halle and formed the basis for the construction of the 0-series built in 1958. For these cars the RAW (Railroad Repair Yard) Halberstadt, with the assistance of the Blankenburg Reichsbahn Development Works, developed and built welding equipment for side walls, roofs, and end walls. The designer collective participating in this work, headed by Graduate Engineer Rehnert, was faced with the two-fold task of fitting the design of the car body for large series production and of designing the fixtures and furnishing for production. Even though the exchange of experiences with the people-owned railroad car construction industry was widely used, the main work was carried out by and large by young engineers of the RAW in close cooperation with the production brigades within a few months. It was a success of socialist team work.

The cars, in their essential features, conformed to the trial car in external appearance as well as in furnishings. Illustration 6 contrasts a renovated car and an old car.

When Graduate Engineer Kramer, the Minister of Transportation, inspected this first series, further measures for raising the comfort of the passengers were decided upon, to be applied to the large series production. These measures concerned the following:

1-- Reduction of the number of seats per compartment from 10 to 8;
2-- Widening the width of the compartment from 1,540 millimeters to 1,600 millimeters;
3-- Enlarging the width of the windows from 1,000 millimeters to 1,200 millimeters;
4-- Improvement of ventilation;
5-- Widening and diagonal arrangement of entrance doors;
6-- Moving the toilette to the anteroom.

The construction was changed according to these principles and the series reconstruction was started in 1959. Illustrations 7 and 8 show the final construction of the three-axle renovated car.

The external characteristic of the final construction as against the first construction is the use of only one wide sliding door in each case diagonally at the right end of the side wall, using the same windows as in the compartments.

The moving of the toilet to the anteroom made it possible to achieve an attractive rectangular arrangement of the seating space, while at the same time adding four seats. Entry and exit of passengers is facilitated by a large anteroom with passage of large useful diameter to the next car and in addition to that by creating a possibility to store baggage in the anteroom. Thus the construction of special cars with compartments for heavy loads is obviated as well as the construction of first-class compartments, since the series cars come up to the upholstered-class cars with regard to comfort by the enlargement of the compartments, of the seat and window widths as well as with regard to the upholstery.

3. Description of the Reconstructed Car

The principal measurements of the car body are shown in Illustration 9. Its most important measurements are:

Length over bumpers	13,120 mm
Length over end wall	12,820 mm
Width of the car	3,043 mm
Height of the car	4,080 mm
Wheel base	7,050-7,080 mm
Number of seats	48
Empty weight	about 19-20 Mp

Basically it is planned to operate the cars in closed units. In the interest of easier operational handling no short coupling was installed and the former pair cars (Paerchenwagen) were provided with bumpers at each end wall. In their exterior, the cars resemble the newly constructed B4uep type. As already mentioned, the trucks of the old three-axle cars are in relatively good condition, so that it is intended to change as little as possible on the truck. This makes it necessary to leave the wheel bases as they are. However, as a matter of principle, the frame of the old car is being extended so that the uniform length of the car body of 12,820 mm is guaranteed. It is planned to equip all suitable two and three axle passenger train cars which have not had a general repair since 1952 with this uniform car body. The following passenger train car types are included in the reconstruction:

P 11, P 12a, P 12b, P 13, P 14a, P 14b, P 15, P 16, P 23, P 25, P 28, and P 29.

For eight of these types, all cars are being reconstructed, so that there will be a significant reduction in the number of types of the remaining railroad passenger car park. The remaining cars of the above-mentioned types, those which have undergone a general repair before, even now offer greater comfort than they did in their former condition. For, during the last few years they were equpped with electric lights, hard upholstery, improved space arrangement, and some other modern features.

3.1 Truck

In the interest of saving expenses, the truck will largely be kept in its old condition. The horn plates, and spring brackets as well as the brake

installation will be left on the truck as far as they are in good condition. If the horn plates are too corroded, pressed axle guards will be welded on. The old wheel sets and journal bearings will be re-used. Since the cars are not to be used for long-distance traffic and since the journal bearings of the cars will receive good care because they are near their home stations, the change to roller bearings was dispensed with. The use of the old journal bearing housings makes it also possible to re-use the springs following appropriate reconditioning without having to adjust the height of the bumpers. Therefore, there will be no additional expenses for the reconstruction of the bearing (Lagerung) at the axle center. These measures proved to be correct in practice, for the cars run quietly after their reconstruction, even at high speeds.

Too heavily corroded long channel bars and crossbars of the truck are replaced by new material. As a general rule, the truck is adjusted to the uniform length by adding (Anschaeften) to both end wall sides. The bumper plank is produced from new material. Since by experience these parts of the car show the heaviest corrosion, the car is being made less sensitive to jolts from shunting by this measure and its life is lengthened. The drawbars are brought up to the uniform car length and the pulling mechanism (Zugapparat) is changed over to the new form. If necessary the center supports are changed. The body supports are welded sideways to the long channel bars. The battery boxes as well as the installations for electric heating of the train are also attached to all car trucks uniformly in the same spot.

The airbrake equipment in most cases remains on the truck. If old brakes are taken out, they are replaced by Hik brakes. All cars will be equipped with brake-rod linkage adjusters and two-piece brake shoes. The hand brake is located in the anteroom next to the door and is operated by means of a hand wheel. The moment of rotation is transferred to the handbrake spindle in the truck via a Gall chain. The emergency brake system runs inside a side wall, the emergency brake system box is placed on the outside under a partition of the anteroom. Furthermore, it is intended to install a conductor's brake valve in the end wall next to the door, covered up by a lid, which in case of emergency can be operated by the switchman when the car is in reverse movement. The truck, after its reconstruction, can be recognized in Illustration 10.

3.2 Car Body

The car body is in shell construction. In each case, the side walls, the roof, and the end walls are produced together and then assembled. These construction elements are made of folded profiles (Abkantprofile) with the outer skin welded to them. Only three thicknesses of sheet metal, 2, 2.5, and 4 mm, are used for folded profiles. The interior of the car without finishing work is shown in Illustration 11. The side and end walls are welded together with the body supports, likewise the roof with the side and end walls. The side wall sheet metal is 2 mm thick and is mechanically butt-welded according to the Elin-Hafergut process. The roof covering is 1.5 mm thick and the sheet metal plate is welded according to the same process. The sidewalls are completely even to facilitate mechanical cleaning while in service. Since the entrance doors on both sides are at the right end of the side walls, only one side wall

welding jig is needed since both side walls are identical. Since the sidewalls are smooth, the welding jig could have a relatively simple construction. The same applies for the roof, which is made completely smooth without any arch or pinch effect, contrary to the test car. Therefore it was possible to make the welding jig simpler and to lower the production costs for the roof. Later four openings are cut into the roof for the ventilators. To fasten the interior covering, some frame shims (Futterhoelzer) are attached to the side walls and to the roof, as shown in Illustration 11. The car body is closed by a bottom plate made of 1.5 mm thick sheet metal. The windows are set into the holes of the side walls by means of rubber sections without any special frame. The entire sheet metal including the profiles are given a triple protective bituminous coat.

3.3 Interior Finishing

As already mentioned, the interior finishing is done with 6 mm thick hard fiber board, which is given a baked enamel coating. (W. Jaenichen: Baked Enamel in Vehicle Construction, Werkstatt, Volume III, 1959, No 6.) For the time being, the hard fiber boards are still being installed unfinished and then they are painted. The hard-fiber boards are installed double as high as the windows, so that their thickness is 12 mm. The hard fiber boards are fastened to the frame shims by means of countersunk screws, the joint and the fastening are covered with cornice molds. The side walls and the haunches of the roof are insulated with Piatherm boards, which completely fill the space between the outside sheet metal and the interior lining. The insulation of the floor is done in part by means of slag wool which is placed between the wooden floor and the sheet metal subfloor. The interior window frames are made of varnished wood into which the fixtures for the upper skylights are built. Just as in the double-decker cars, the windows are firmly attached at the bottom and can be pulled back to the interior at the top. The upper window can be fixed in a tilted position by means of the ventilation fixture. The baggage racks made of elox-idized aluminum are along the side walls above the windows. The baggage racks have the measurements customary for new railroad cars and are appropriately subdivided. The interior lining of the roof is protected against damage above the baggage racks by means of molding. The roof lining is painted ivory, the side walls are silvergrey on top and up to the window sill light green, all in Hammerschlag baked enamel. These colors blend in with the dark green upholstery and the reddish brown window and door panels.

The seats are made of a welded closed tubular frame with upholstered arm rests. The upholstery material is made of foam rubber which is placed on top of plywood and is covered with light green artificial leather. The back-rest, except for the end wall seats, is finished on both sides. Production and repair are thus very simple and require small expenditures for wages. All up-holstery is easily replaceable, so that damaged upholstered parts can be ex-changed from available parts in stock while the car is in operation. The tubu-lar frame as well as the waste containers under the windows are painted with light green Hammerschlag baked enamel. On the tubular frame under the seat, there are attachment collars for the electrical heating units; the metal heat

insulators are attached in a simple fashion. In this manner, the floor is kept free for mechanical cleaning equipment. Adequate ventilation is achieved by four standard ventilators, which can be operated by regulating devices between the windows. The ventilation shaft between the outer cover and the false ceiling is covered below by a nickel-plated grate. The partitions to the anteroom and the toilet also consist of hard-fiber board covered with baked enamel. The interior of the car is closed off from the anteroom on both sides by means of wide wooden sliding doors. The sliding door has the standard lock customary in four-axle compartment cars and its upper part has a glass window.

Since the seats in the series construction have only two places each, they are the same on both sides and thus there is a relatively wide center passageway of 650 mm. All aluminum parts used in the construction of the car, especially the window frames, are eloxadized.

3. Lighting

The interior of the car has standard "Arnsdorfer" light fixtures with two bulbs each. There are two light fixtures over each compartment so that a ratio of luminous flux to area of element of surface of 40-60 lux is achieved. Over the intermediate doors, there are one-bulb light fixtures, the same also in the anteroom directly over the door. The standard light installation of the VEB Vehicle Equipment Enterprise with 24 Volt tension is being used. The generator is fastened to the truck and is driven by an end axle with a belt. The battery is fastened to the truck at the usual place. The switch box is on the partition of the car in the anteroom in which there is no toilet. The train tail lanterns are firmly installed in the end wall; there is no longer any difference between day and night signals. On the end walls, there are plugs which make it possible to connect two cars if the light installation of one car should fail. In addition, there are plugs on the side walls of the car which make it possible to feed in 220 Volt current. In the interior of the car in the switch box there are plugs connected to this network, to supply electricity for vacuum cleaners for the interior equipment of the car.

3.5 Heating

The car is equipped with a low pressure steam heating equipment delivered by the VEB Vehicle Equipment Enterprise. The main and regulating valve is controlled by a control installation fastened to the partitation of the interior of the car. The heating coils are located behind a protective covering below the window along the side of the car and in the anteroom in the partition. In the toilet, the heating element is in an upright position and covered by a sheet-metal box. The main steam line, as in the past, has been placed under the car. About half of the cars are provided with electric heating for use on electrified lines; however, provisions have been made to install [electric heating] in all cars. The heating elements are attached to the seat frame below the seat. Just as in the case of steam heat, it is regulated from the interior of the car. The other switching equipment is fastened to the long channel bar underneath the car. In the anteroom and in the toilet the electric heating elements, just as the steam heating elements, are placed under protective covering.

3.6 Anteroom, Toilet, and Passage to the Next Car

To make quick entry to and exit from the car possible, the anterooms were considerably enlarged as compared to the 0-series. The door is 1,310 mm wide, so that two passengers may on occasion leave the car together. The wide sliding door, which has the same window as the compartments, however with a fixed upper part, operates to the left to the interior of the car. For this reason, the window of the first compartment is placed in a shaft into which the sliding door is pushed when it is opened. The shaft is covered with a second window to the inside, which can be moved in the direction of the partition for cleaning. Because of the shaft the width of the seat is slightly narrower, only about 80 mm. In building the anteroom, special attention was paid to making the passage to the next car as big as possible. For this reason, the end wall door was divided into six parts and when it is open it is folded toward the end wall or the toiletside wall in a harmonica-like fashion. The passage does not have any steps, so that there is no danger of an accident. When the cars are coupled, the anterooms are connected without any significant narrowing of the passage (Illustration 12). In this manner the passenger can move very readily in the railroad stations. In the two anterooms, up to 36 passengers can find room, a fact which is of special advantage for rapid exit in commuter traffic. Because of the wide passageway, it is also no obstacle that there is only one exit on one side at the end of each car.

Special lighting for the steps, which had been included in the test car, was eliminated because many repairs are required; instead, the light fixture in the anteroom was placed on the ceiling of the anteroom almost directly over the steps and lights up the entrance well. The sliding door covers the two steps, which are made of metal mesh, toward the interior by means of an apron. The toilet is located in one of the two anterooms of the car, opposite the entrance. It is entered by a door behind which the heating element is fastened. Next to the entrance door, on the partition to the anteroom, there is the wash basin. The towel box is fastened to the end wall. In addition lids are attached to this wall, just as in the anteroom, which make it possible to have access to the tail lamp fixture and to fasten the rubber bulge. The flushing of the toilet as well as the stopper of the wash basin are operated by foot levers; the standard fixtures for four-axle cars are being used. The water box is located over the toilet and the anteroom. The toilet window is made in the same manner as the compartment windows, except that it is made of frosted glass. In the second anteroom of the car, the switch box for electric lighting is located on the partition wall headhigh. In this room there is therefore the possibility to comfortably place heavy loads, as well as baby carriages opposite the entrance door. The window in this anteroom is equipped with ventilation in the customary manner. For the passages between cars a rubber bellows is used which seals itself when two cars are coupled. The passage bridges overlap and can be folded upward and made immobile if the end wall door is closed.

4. Technology of Reconstruction

According to the Law on the Seven-Year Plan, 3,000 cars must be recon-

structed. Plans call for the completion of the program by 1962. In view of the fact that by the end of 1959 some 150 cars had been completed, about 850-1,000 cars a year must be reconstructed up to 1962. These figures mean that 70 - 85 cars must leave the repair yards each month. Since the devices for the production of the sidewalls and roofs are relatively expensive, attempts had to be made to get along with as small a number as possible. The determination of the capacity of these devices showed that sidewalls and roofs for about 40-45 cars a month can be produced with one set of the devices. Therefore, two sets of these devices are needed if the program is to be carried out as scheduled. Since, on the other hand, the assembly of car bodies, the interior finishing, and especially the lacquering require a large number of stands, it was not possible to carry out the assembly work in a repair yard. It was therefore decided to free the RAW Halberstadt from any duties other than this program and, beyond that, to use RAW Schoeneweide as a second yard to assist in the assembly work. To assemble the car bodies and to service the welding jigs, special cranes are necessary which make it possible to lift the welded parts high enough so that the intermediate stands can be used while the parts are transported. These cranes were available in the RAW Schoeneweide while in the RAW Halberstadt a traveling crane had to be especially installed in the car shed for this purpose. To ease the load on the two repair yards with regard to dismantling work on the old car bodies, the dismantling of the cars and the reconditioning of the trucks were transferred to the RAW Wittenberge, which is now the home RAW for part of the cars to be reconstructed. The production of outside doors, inside doors, upholstery, end wall doors, passage bridges, water boxes, and seat frames is being centrally done for both assembly yards in the RAWS Wittenberge, Gotha, and Leipzig. Thus series production was made possible and, beyond that, in these yeards, which so far were kept busy with the systematic maintenance of the old cars, manpower utilization was made possible without great changes. Nevertheless, there was a great change for all the yards participating in this program, to change over from the systematic repair of cars to series production of vehicles or vehicle parts. Even though extensive attempts were made to limit manual welding by applying automatic welding processes, there was a great demand for welders in all yards while wood craftsmen /?carpenters?/ were no longer needed in the same number as before. This resulted in the necessity of retraining or learning a second profession. A great many artisans were not familiar with work according to blueprints and caliber. In addition, the course of production as well as work preparation and enterprise organization in the assembly plants had to be completely changed. For this purpose, a collective of the development office for technology and organization of the RAWs from Zwickau (ES-RAW) had to be assigned to the RAW Halberstadt. With the assistance of the collective, the new organization and production according to modern principles were set up, operating according to the assembly-line system. The interior finishing of the cars is taking place on longitudinal stands arranged in U-shape. The assembly of the car bodies as well as interior and exterior painting are taking place on transverse stands placed at the beginning and at the end of the assembly line. The work flow proposed by the ES-RAW is shown in the flow chart (Illustration 13). It is subdivided into six main parts:

1-- Taking apart old cars, dismantling and cleaning parts, and removing rust

2-- Completely assembling trucks in the former locomotive hall, including running gear, mechanical brake, compressed-air brake parts partially, and main steam line;

3-- Building up car body, completing the welding, and aligning;

4-- Preliminary assembly;

5-- Lacquering work, whereby painting work is carried out on the assembly line tracks and between the individual main parts on special stands;

6-- Final assembly, including final testing.

Because of the above-mentioned cooperation relations, the assembly plants need not perform parts 1 and 2.

The work diagram shows a transit time of 21 days for three-shift operation with a monthly output of 32 cars. With 32 cycles, there is a cycle time of 16 hours requiring 35 stands. Thus the average work density per stand is 4.2.

In the RAW Schoeneweide, assembly and interior finishing take place on adjoining transverse stands, through which the car body is put by the cycle method, using the claw crane operating over the stands.

By changing to the assembly line method, the RAW Halberstadt was able to increase the monthly output during the second half of 1959 to 25 cars. For 1960, a further increase by 10 cars a month is necessary and, as shown above, possible. After the government offices concerned had decided on the implementation of the reconstruction program for passenger train cars, the general repair of the car types scheduled for reconstruction was stopped at the end of the first half of 1959 and the cars scheduled for main inspection were channeled to the reconstruction program as a routine matter. As reconstruction output increases, cars scheduled for annual inspection must be reconstructed. In addition, special work, such as installation of new heating units and light installations in the carpark, was stopped. The manpower, materials, and funds thus becoming available were used for the reconstruction program. The cooperation arrangements with the individual yards, described above, made it possible to utilize available workers at their old place of work and according to their qualifications. The RAW Schoeneweide and the RAW Leipzig took over the installation of electrical heating equipment in view of the skilled craftsmen available there. The RAW Halberstadt was most affected by the change-over since it is now being used for the reconstruction of the cars exclusively and does not perform any maintenance work on the car park.

RAW "Einheit", Leipzig, is scheduled to take over the maintenance of the reconstructed cars. Because of the shape of its buildings it is especially suited to repair on long assembly lines the standardized reconstructed cars economically and with short stays in the repair yard.

4.1 Mounting of the New Car Body

As mentioned under 3 above, the framework of the new car body consists of folded profiles. About 20 profiles of three thicknesses of sheet (2, 2.5, and 4mm) are in use. They are cut in series on modern impact cutters (Schlagschere), the corners and angles are cracked (geknackt) under eccentric presses and then bent on bending presses. The profiles for the most part are produced

in the assembly plants, a lesser part is delivered in bundles by cooperation of other repair yards which possess appropriate installations. To ease the load on the large welding jigs, the profiles, which clearly constitute the bottleneck in production, are welded into sections on small jigs. These sections are joined on the side wall welding jig or roof welding jig, see Illustrations 14 and 15. Furthermore, these jigs serve the purpose of welding the outer cover or roof cover to the framework. This takes place in part by hand with fillet welding, in part with deep burning electrons or underpowder rivet hole welding jigs. The cutting of the side walls and of the roof cover is done on the impact cutter, the cutting out of the window holes with special curve-cutting machines. The welding of the individual sheets is carried out on a commercial EHB welding m machine from the VEB Kjelberg, Finsterwalde, for 1.50 meter sheet length and on an EHV welding machine developed by the ES_RAW Zwickau (K. Birkholz: From the Work of the Development Office for Technology and Organization of the RAW (ES-RAW), Deutsche Eisenbahntechnik, Volume VII, 1959, No 6, page 275) for 4-meter welds. In this manner a distortion-free welding of the sheet metal is achieved and, beyond that, the refinishing of the welded joints is considerably lessened.

The side walls welded in the jig are taken out of it by means of the crane and stored upright in an intermediate storage place until they are assembled, an operation which takes place under the same crane runway. The completely welded roof is removed from the jig with a special gripping attachment and is stored on a special stand for work on the welds and for cutting the holes for the ventilators. From there the roof is picked up with the same gripping attachment and mounted on the two side walls, see Illustration 17. The welding jigs are rotary so that the welding can take place in the H.V. position (Wannenlage) if possible. The clamping devices for the roof welding jig can be seen especially in Illustration 18.

The sidewalls are placed on the completed truck by means of the crane and are held with temporary clamping devices until the roof is put on. After the truck, the side walls, and the roof have been fastened to one another, an exact measuring and straightening of the car body takes place, then the final welding. After the straightening of the side sheets by means of carbon electrodes, the car body on its truck now rolls to the interior painting stand where it gets a bituminous protective coat. Then it is placed on the assembly line where the installation of the interior installations takes place on the individual stands (see Illustration 13). For the production of the outside doors folded profiles are used likewise, which are covered with sheet metal and are spot-welded inside and outside.

5. Development of Costs

The plan provides for an average cost for each car of the entire reconstruction program of two and three axle passenger car trains. However, these cost limits can only be maintained if the production is carried out by making use of all possibilities for cost reduction offered by modern technology and by making use of all proposals of the working people to improve the work processes. Beyond that, the costs are, of course, strongly influenced by the familiarity of

the workers with the work. This familiarity with the work could be seen especially in the RAW Halberstadt if one looks at the development of the average costs of a car in 1959. While in March 1959 the costs of the first cars of the series were almost 80 percent higher than the planned average costs, the costs decreased to 20 percent more than planned by December 1959. Once the average cost provided in the plan is reached, the share of materials in the cost will be preponderant. Here the steam-heating installations and the electric light installations in particular weigh heavily. For these items as well as for the initial material and also for other replacement and exchange parts there are legally prescribed fixed prices which cannot be influenced by the plant. The cost development in 1959 is shown in the curve in Illustration 19.

Many improvement proposals for further cost reduction have been submitted by the working people of the repair yards participating in the production. Some of the proposals are concerned with simplification of construction, others with improvement of work processes. The improvement proposals constitute an important part of the cost reduction which was achieved.

6. Prospects

Proposals which deal with the improvement of the construction of the car, however, were put into effect only if the interchangeability of the used parts was not affected or if they contributed to an increase in operational safety. A work team was formed which deals with the evaluation of the remaining proposals for improving the construction details of the reconstructed cars or those to be expected in the future. In view of the bad experiences made in the Bww's and in the RAWs with the newly constructed vehicles delivered recently, it is planned in the interest of the maintenance of the principle of standardization, to collect these proposals, to analyze them thoroughly, and to introduce all /those approved/ at one time so that there will be only two types of reconstructed cars in the future. Later on it must be determined how far, on the occasion of the main inspection, the first type of construction should be changed to the second, final, type.

The planned improvements include: Baking of the outside painting in order to thus attain a better appearance, a greater durability, especially for mechanical cleaning. The insulation material against heat and sound now in use does not meet demands. New methods for insulating the car body are now being tested. The present use of plastic materials is inadequate. They will be economically usable for the subfloor of the car body as well as for the ceiling molding of the interior finishing. Here, too, experiments and tests are necessary. The baking of the ceiling paint in the passenger space would achieve savings as well as an improvement in quality. Special equipment is to be developed for this purpose.

Furthermore, the intensity of the lighting could be improved if an efficient and light-weight light dynamo could be developed.

Many problems are still awaiting solution by the working people of the RAWs and the scientists in the experimental and development offices. The settlement of these problems is also necessary in the interest of the planned expansion of the reconstruction program to a part of the existing four-axle

passenger-car park during the final years of the Seven-Year Plan. It is intended to use the same construction elements and exchange parts for the car body as in the case of the three-axle car. Likewise, many of the standardized exchange parts now being used in the reconstruction program should be utilized in the modernization and standardization of the remaining passenger car park in the interest of reducing the stocks of these parts. The successful preparation and implementation of the reconstruction program of the two and three axle passenger cars is a product of socialist team work. The experiences of the workers and those of the people with long experience influenced in every phase of development the work of the young designers and technologists. It is the merit of this great socialist collective when /possibly if/ the reconstructed passenger train cars are achieving high technical standard and travel comfort with a relatively small expenditure of money and material.

ILLUSTRATION APPENDIX

Illustration 9: Switch Box — Passage open, doors folded — Passage closed

Three-axle reconstructed car
Wheel base: 7.5 meters

Bitumen Spraying Stand — Forge — Dismantling Stand

Profiles

Lacquering Shop — Storage Place for Cleaned Sheet Metal — Construction Groups — Carpenter's Shop — Rust Removal — Truck Production

Sheet Metal

Welding of Car bodies — Storage Place for Frame Shims

Mounting of Car Bodies

Electric Fitter

Work on Wheel Sets

Bumper Bars and Crossbars

Assembly Track-- Preliminary Assembly

Assembly Track-- Final Assembly

Final Test Stand

Work Stand No	Work to Be Done
1	Dismantling and removal of the car body from the truck, dismantling of locks
Crane	Lifting and loading of car body
2	Dismantling of truck
3	Assembling and welding of truck
4	Installing the mechanical brake parts, main steam line, pulling and pushing gear
5	Placing wheel sets on truck and measuring
5	First control point
6	First coat of paint for truck

Work Stand No	Work to Be Done
7 or 8	Mounting side and end walls and roof
9 or 10	Welding car body, sheet metal floor, partitions, straightening work
11	Spraying inside of car body three times with bitumen
12	First coat of paint for roof, first white lead coat for car body
12	Second control point
13	Installing pinewood packing pieces, slag wool, and floor boards
13/14	Installing shims
14/15	Installing ventilator fixtures
14/15	Installing electric lines
15/16	Installing interior
16	Fitting outside doors and taking them off
17	Applying floor surface coat, installing floor coverings
18	Applying brush filler to car body
18	Smoothing roof welds
18	Fastening battery boxes, cable board, protective boxes for electric heating
19	Installing regulators, switch panel, dynamo, battery, etc.
20	Grinding roof filler
20	Hanging outside door
20	Installing steam heating system, insulating main steam line
20	Installing emergency brake equipment
20	Third control point
21	Second coat of paint for roof
21-27	Smoothing and grinding car body five times
21-27	All other interior painting, installing tiles and outlet pipe
28	Spraying car green on the outside, three times
29	Spraying second coat on truck
29	Spraying third coat on truck
30	Applying third coat of paint to roof
	Fourth control point
31	Installation of window
31/32	Finishing toilet
31	Tilted windows (Kippfenster)
31/32	Window frames
32/33	Cleat work (Leistenarbeit)
32	Compressed-air brake, install and test pneumatic part
32	Install light fixtures and other electric equipment
32/33	Install baggage racks
33	Install seat benches
33	Install interior and toilet doors
34	Inscriptions and ornaments and other painting work
34	Fastening profile rubber to sliding doors and making them lockable
34	Install sealing felt and rubber bulges
34	Fasten signs and metal fittings
35	Final cleaning

5897

END